Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans
Canadian Science Advisory Secretariat
Gulf Region | Science Response 2016/018

UPDATE OF STOCK STATUS OF ATLANTIC SALMON (*SALMO SALAR*) IN DFO GULF REGION (SALMON FISHING AREAS 15 TO 18) FOR 2015

Context

The last assessment of stock status of Atlantic salmon for Fisheries and Oceans Canada (DFO) Gulf Region was completed after the 2013 return year (DFO 2014) and updates on stock status in 2014 for each of the four Salmon Fishing Areas (SFA 15-18) were prepared (DFO 2015a; DFO 2015b). DFO Fisheries and Aquaculture Management (FAM) requested an update of the status of the Atlantic Salmon stocks in DFO Gulf Region for 2015. Indicators for adult and juvenile Atlantic Salmon stocks in SFAs 15 - 18 are provided in this report. This Science Response Report results from the Science Response Process of 18 February 2016 on the Atlantic Salmon update of indicators for 2015. No other publications will be produced from this science response process.

Background

All rivers of the Maritime provinces flowing into the southern Gulf of St. Lawrence are included in DFO Gulf Region. There are four Atlantic Salmon (*Salmo salar*) fishing areas (SFA 15 to 18) in DFO Gulf Region encompassing portions of New Brunswick, Nova Scotia, and all of Prince Edward Island) (Fig. 1).

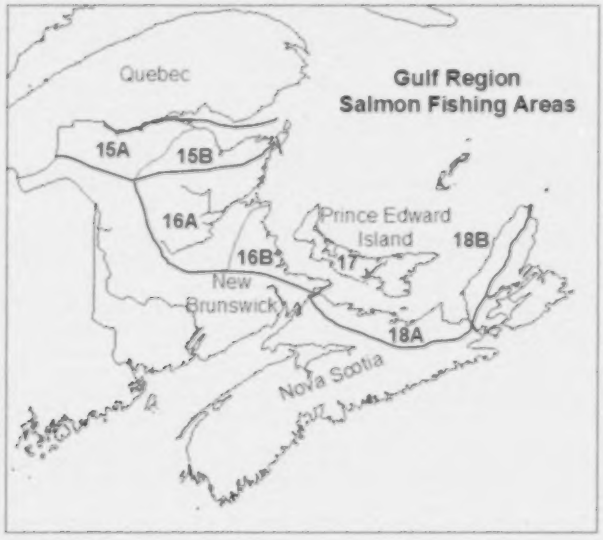

Figure 1. Salmon Fishing Areas in the DFO Gulf Region.

Canada

For management purposes, Atlantic Salmon are categorized as small salmon (grilse; fish with a fork length less than 63 cm) and large salmon (fish with a fork length equal to or greater than 63 cm).

In 2015, mandatory catch and release measures were introduced in the recreational fisheries in all Salmon Fishing Areas. This was a change from 2014 when retention of small salmon had been allowed in SFA 15, SFA 16A, and SFA 18. In 2015, rivers in south east New Brunswick (SFA 16B) remained closed to all directed salmon fishing.

Analysis and Response

Abundance indices of adult salmon

SFA 15 - Restigouche River

Information on adult salmon abundance from the Restigouche River (NB; excluding Matapedia River which is entirely within the province of Quebec) comes from angling catches and effort as well as end of season spawner counts. For recreational fisheries, catches in the Restigouche River are based on lodge catch reports compiled by DFO Science and Crown Reserve angling catches compiled by the province of New Brunswick, and exclude catches from public water. As of the date of this review, the catch data from lodges for 2015 are incomplete with information missing for 6 of 24 lodges. Catches from all lodges were estimated by assuming that the catch data from the missing lodges was of the same proportion to total catches based on the previous five years. Effort from lodges and leases in 2015 was estimated at 5,600 rod days, similar to the reported effort in 2014 and relative to the previous five year average (5,952 rod days). Total anglers registered in Crown Reserve waters in 2015 decreased by 31% from 2014 (986 anglers in 2015 compared to 1,428 in 2014). Only 28% had returned creel forms. Crown Reserve catches were estimated by raising the returned creel forms to total effort based on the total anglers. Combined, the provisional recreational fishery catches for 2015 for the New Brunswick portion of the Restigouche River (excluding Matapedia River) are 2,332 large salmon and 2,942 small salmon.

Based on an assumed angling exploitation rate of 40% and raised by estimates of New Brunswick side harvests in the estuary (historical commercial and aboriginal harvests), an approach similar to previous assessments (DFO 2014), returns to the Restigouche River (NB) in 2015 were estimated at 6,100 large salmon and 7,400 small salmon (Fig. 2).

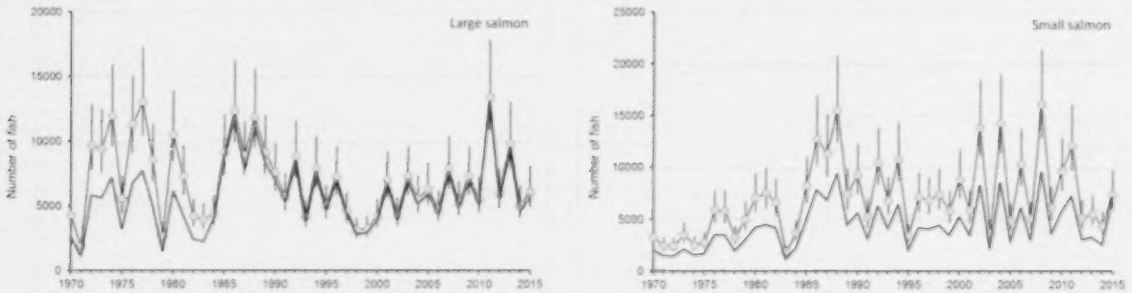

Figure 2. Returns (grey circle) and spawners (solid line) of large salmon (left) and small salmon (right) to Restigouche River (NB portion) 1970 to 2015. The grey circle symbols are returns based on 40% catch rate and vertical error bars show the range based on catch rates of 30% to 50%. The solid line is spawners based on 40% catch rate assumption. The data for 2015 are preliminary.

The estimated large salmon spawners were equivalent to 107% of the conservation requirement. Based on an angling exploitation rate of 40%, the Restigouche River (NB portion) has met or exceeded the conservation egg requirement in 6 of the last 10 years (Fig. 3).

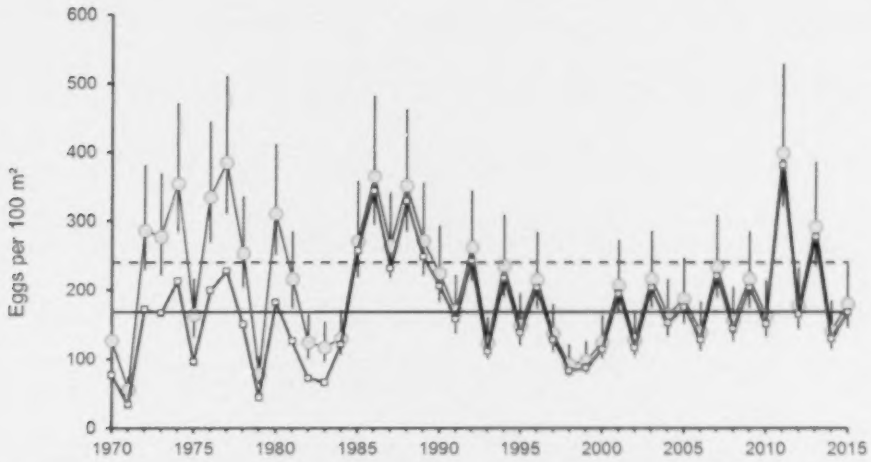

Figure 3. The potential eggs (expressed as eggs per 100 m² of wetted habitat area; total area of 21.6 million m²) by large salmon for the returns (grey circles are assumed catch rate of 40%, error bars show range for catch rates of 30% to 50%) and the spawners (white square symbols for an assumed catch rate of 40%) in the New Brunswick portion of the Restigouche River, 1970 to 2015. The solid horizontal line is the egg deposition rate of 168 eggs per 100 m² presently used to assess attainment of conservation for the Restigouche River. The dashed horizontal line is the egg deposition rate corresponding to 240 eggs per 100 m² used in other rivers of Gulf Region. The estimates for 2015 are based on preliminary data.

Assessments on the Restigouche River are also informed by spawner counts at the end of the season, after all fisheries and in river losses. In late September 2015, end of season spawner counts were conducted in all four Restigouche (NB) tributaries (Kedgwick, Little Main Restigouche, Upsalquitch, and Patapedia) and the main stem Restigouche (Fig. 4). Counts derived from snorkelling should be considered a minimum estimate of spawners. Water levels were low and visibility was generally fair during 2015 surveys. The large salmon spawner counts in 2015 were below the specific conservation requirements in each tributary (49% for the Kedgwick, 51% for the Little Main Restigouche, 88% for the Upsalquitch, 32% for the Patapedia) but above for the main stem Restigouche River (119%). Spawner counts from the Matapedia (including Causapscal) and the Patapedia rivers in late October 2015, as reported by the Province of Quebec, were 100% and 152% of conservation requirements, respectively.

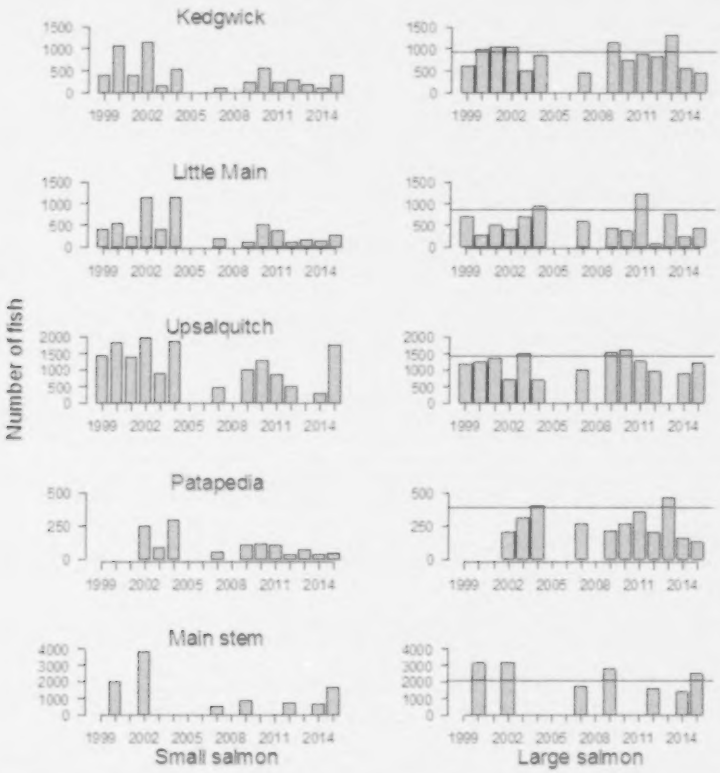

Figure 4. End of season salmon counts by size group (small salmon left column, large salmon right column) from four tributaries and the main stem of the Restigouche River for 1999 to 2015. The solid horizontal lines in the large salmon panels are the area specific conservation requirements expressed as large salmon. Spawner counts could not be completed in all years depending on water conditions.

SFA 16 - Miramichi River

The Miramichi River is the largest river in SFA 16 and DFO Gulf Region. Returns of small and large salmon are estimated using mark and recapture experiments based on catches at various monitoring facilities throughout the watershed (DFO 2014). The estimates in the time series are not adjusted for periods when the counting facilities were not operating due to high water events. In 2015, the Southwest Miramichi trapnet at Millerton did not operate after September 29 and the trapnet at Cassilis on the Northwest Miramichi did not operate from September 30 to October 6 due to a high water event.

Catches of large salmon in 2015 were improved at the Northwest trapnet relative to 2014 but not at the Southwest trapnet. Catches of small salmon were improved at both trapnets relative to 2014 (Fig. 5). Catches at the Southwest Miramichi trapnet in 2015 were below the long term averages for both size groups at that facility (Fig. 5). Catches of large salmon at the Northwest trapnet in 2015 were just under the long term average catch for large salmon but catches of small salmon were above the long term average and ranked third overall in the time series (Fig. 5).

The headwater barrier on the Dungarvon River, tributary of the Renous and Southwest Miramichi rivers did not operate between October 1 and October 5, 2015 because of a high

water event which damaged the facility. Counts of both large and small salmon at the Dungarvon Barrier in 2015 were improved over 2014 with 328 small and 232 large salmon. The large salmon count at the Dungarvon barrier in 2015 was above the long term average count of large salmon at that facility, however the small salmon count was below the long term average for that size group at that facility (Fig. 5).The Northwest Miramichi Barrier remained in continuous operation from June 2 to October 22, 2015. Counts at the Northwest Miramichi Barrier in 2015 were 310 small salmon and 98 large salmon, modest improvements over 2014 levels but well below the long term average for those size groups at that facility and among the lowest of the time series (Fig. 5).

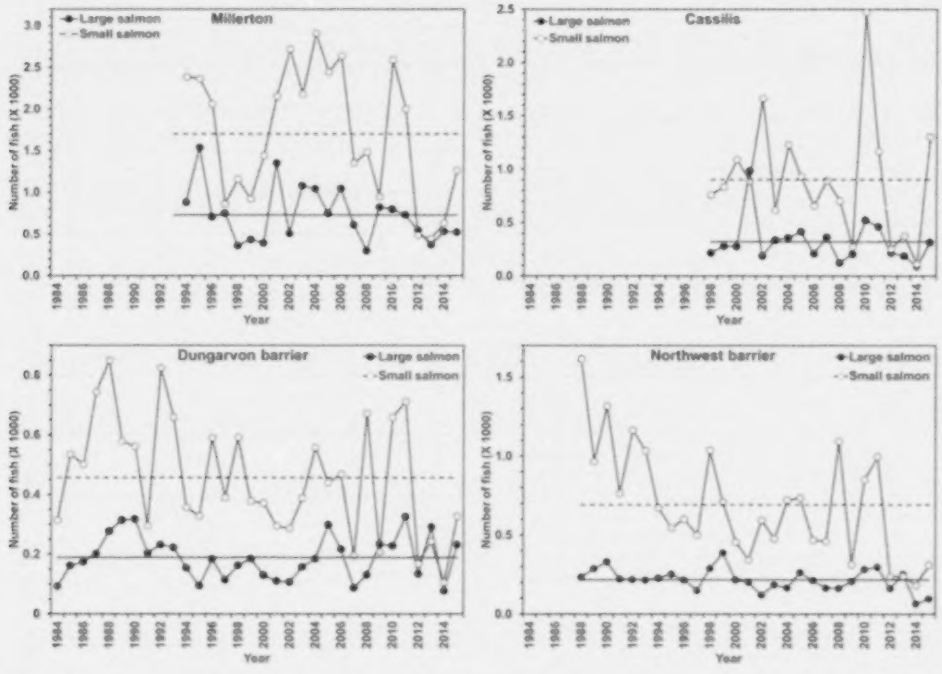

Figure 5. Catches of small and large salmon at DFO index trapnets (top row) at Millerton on the Southwest Miramichi River (left panel) and at Cassilis on the Northwest Miramichi River (right panel) and at provincial headwater barriers (bottom row) in the Dungarvon River, tributary of the Southwest Miramichi River (left panel) and the Northwest Miramichi River (right panel) between 1984 and 2015.The horizontal solid and dashed lines represent the average catch or count of large and small salmon, respectively, for the time series of the facility depicted.

The estimated returns of large salmon to the Miramichi River in 2015 were 15,870 fish (median; 95% confidence interval of 12,440 to 20,820), while small salmon returns were estimated at 26,120 fish (95% C.I. 22,480 to 30,340). Returns in 2015 of large and particularly small salmon to the Miramichi River overall were improved over 2014 and were near the previous 5 and 10 year average returns for each size group. Returns of both large and small salmon to the Miramichi River in 2015 were well below the average return estimates for each size group for the time series (1971-2015) (Fig. 6).

Estimates for the two main branches of the Miramichi River are available since 1992 (Fig. 6). The returns of large salmon to the Southwest Miramichi River in 2015 were estimated at 11,490 fish (95% C.I. 8,280 – 16,360), while small salmon returns were estimated at 13,980 fish

(median; 95% C.I. 10,840 to 17,990) (Fig. 6). The returns of both large and particularly small salmon to the Southwest Miramichi River in 2015 were improved over 2014 levels but both size groups were well below their previous 5, 10, and 24 (complete time series 1992-2015) year averages (Fig. 6).

The returns of large salmon to the Northwest Miramichi River were estimated at 4,171 fish (median, 95% C.I. 2,828 to 6,266), while small salmon returns were estimated at 11,980 fish (median, 95% C.I. 9,771 to 14,750) (Fig. 6). These return estimates represented a large increase of both large and small salmon to the Northwest Miramichi in 2015 relative to 2014, and were higher than the previous 5 and 10 year average return estimates for both size groups. The return estimate of small salmon to the Northwest Miramichi River in 2015 was just below the average for the complete time series (1992 – 2015) while the large salmon return estimate was below the average for the same time series.

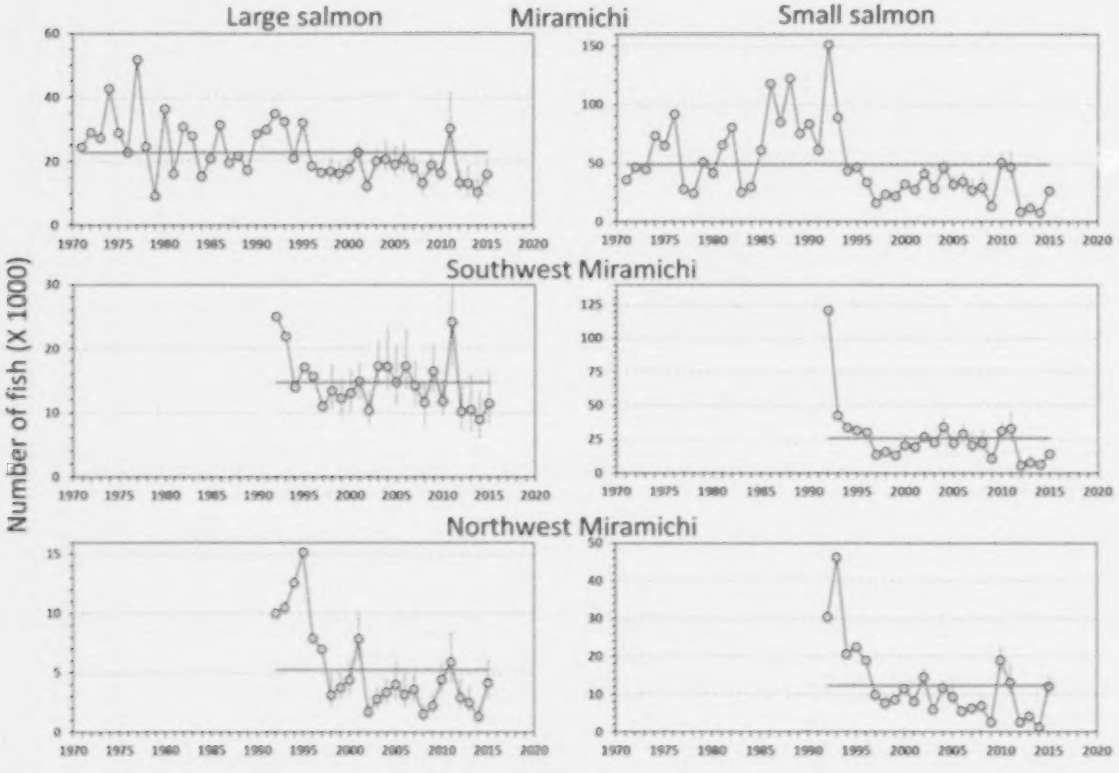

Figure 6. Estimates (median and 5th to 95th percentile range) of large salmon (left column) and small salmon (right column) returns for the Miramichi River for 1971-2015 (upper row), the Southwest Miramichi River 1992-2015 (middle row), and the Northwest Miramichi River 1992-2015 (bottom row). The red horizontal lines depict the average return estimates of large or small salmon for the rivers' time series.

Considering the biological characteristics (length, proportion female) of salmon in 2015, the estimated total eggs in the returns of large and small salmon combined were equivalent to 89% of the conservation requirement for the Miramichi River overall, 92% of the conservation requirement for the Southwest Miramichi River, and 82% of the conservation requirement for the Northwest Miramichi River (Fig. 7). While none of the three rivers attained conservation requirements in 2015, they were all greatly improved from the lowest levels of the time series

(1992 to 2015) in 2014. The eggs in the combined returns of small and large salmon to the Southwest Miramichi River have exceeded the conservation requirement in most years (14 of 24) since 1992. The eggs in the combined returns of small and large salmon to the Northwest Miramichi River have been sufficient to meet the conservation requirement eight times since 1992, the most recent being 2011 (Fig. 7). The percentages of conservation requirements attained after harvests and losses from fisheries will be less than the values reported here although losses in 2015 would be expected to be much lower than in previous years due to fisheries management changes.

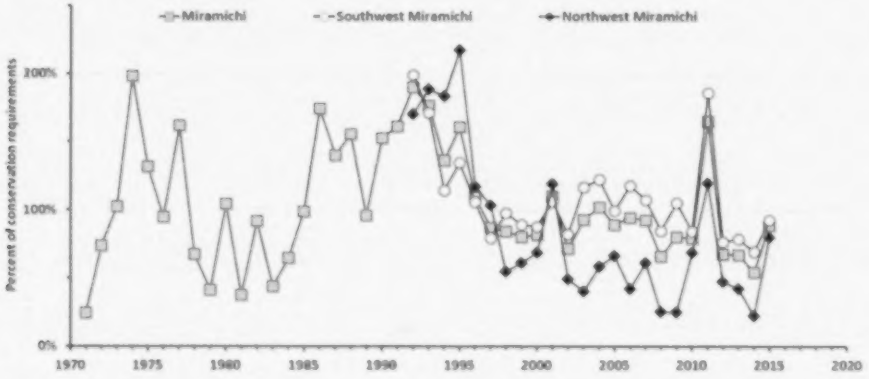

Figure 7. Percentages of the conservation requirements (eggs) attained in the returns of small and large salmon combined from the Miramichi River overall (1971 to 2015), the Southwest Miramichi (1992 to 2015) and the Northwest Miramichi (1992 to 2015) rivers.

High water conditions in late September 2015 resulted in the main assessment facility of the Southwest Miramichi (estuary trapnet) being out of operation for the remainder of the year. In the past five years, the proportion of the total annual catches that occurred after Sept. 30 averaged 12% (6% to 22%). Estimated returns to the Southwest Miramichi and the Miramichi overall may have been higher by that approximate amount. The trapnet in the Northwest Miramichi was out of operation for seven days in early October but continued operating afterward to the end of the season.

SFA 17

Salmon redds have been surveyed in all rivers in PEI that currently have salmon at least once since 1990. The methods for converting redd counts to female salmon spawners and assessing against attainment of river specific conservation requirements are described by Cairns and MacFarlane (2015).

There are 26 rivers in SFA 17 in which Atlantic Salmon occupancy has been confirmed at least once in 2008-2015, based on observations of redds or juveniles (Table 1). Estimated spawning escapements exceeded conservation requirements in 6 of 16 rivers which had complete surveys in 2015 (Table 1). Based on the most recent available data, estimated escapements exceeded requirements in seven of the 26 rivers. Rivers exceeding conservation requirement are concentrated in the Northeast extremity of PEI (Fig. 8). On a number of rivers, adult salmon abundance has regularly been less than 50% of conservation. In several smaller rivers, available redd and juvenile survey data suggest that spawning occurs only in intermittent years.

Table 1. The percentage attainment of the Atlantic Salmon conservation requirements in monitored rivers of SFA 17 from 2008 to 2015. A dash indicates no survey was completed.

River	2008	2009	2010	2011	2012	2013	2014	2015
Cains Brook	144 [a]	-	-	139	102	95	-	95 [a]
Carruthers Brook	244 [a]	-	-	472	210	157 [a]	-	165 [a]
Trout River, Coleman	1 [a]	-	-	-	-	24	15	15
Trout River, Tyne Valley	13	-	-	-	-	0	0	-
Little Trout River	24	42	20 [a]	61	-	0	0 [c]	4
Bristol (Berrigans) Creek	8	-	26	-	7	11	0	1 [a]
Morell River	79	-	-	108	58 [a]	78 [a]	93	34 [a]
Midgell River	50	85	-	80	59	26 [a]	55	102
St. Peters River	55	-	-	55	73	46	45	70
Cow River	-	-	-	-	2	102	24	137
Naufrage River	107	34	35	459	46	484	232	165
Bear River	-	-	-	-	-	43	8	35
Hay River	-	-	-	2	5	78	27	65
Cross Creek	126	74	119	200	87	282	203	250
Priest Pond Creek	21 [a]	15	26	37	39	283	242	258
North Lake Creek	195	208	200	346	103	325	178	256
Vernon River	0	-	-	-	5	7	5 [a]	0
Seal River (Vernon)	-	-	-	-	-	-	-	36
Clarks Creek	0	-	-	-	0	3	-	0 [a]
Pisquid River	37	-	36 [a]	67	34	38	15 [a]	46
Head of Hillsborough R.	0	-	-	0	0	2	-	0
North River	9	-	-	5	-	10	-	-
Clyde River	-	-	-	0	- [b]	- [b]	- [b]	- [b]
West River	44	15	27	28	27	52	35	35
Dunk River	5 [a]	-	-	-	4 [a]	-	-	-
Wilmot River	0	-	-	-	-	-	- [c]	- [c]

[a] Considered to be a minimum value due to incomplete survey coverage.
[b] Juveniles were found by electrofishing in 2012 but not in 2013, 2014, and 2015.
[c] Juveniles were found by electrofishing in 2014 and 2015.

Figure 8. Location of rivers (arrow symbols) for which redd counts were conducted from 2008 to 2015 and summary of the status of the rivers relative to the percentage of the conservation requirements attained in 2015, and in the most recent year assessed if not surveyed in 2015. The symbols are interpreted as follows: 🡻 less than 90% of conservation requirements attained, ⇔ between 90% and 110% of conservation requirements, and 🡹 greater than 110% of conservation requirements. The black symbols refer to 2015 values in rivers and the brown symbols refer to the most recent value during 2008-2014 if not surveyed in 2015. The watershed blue shading refers to conservation having been met or exceeded in the most recent year assessed (including 2015), green shading refers to being less than conservation, and pink shading indicates watersheds for which there has been no recent (since 2008) evidence of salmon presence.

SFA 18

Indices of abundance from the recreational fishery for 2015 are preliminary and based on extracts from the licence stub return database to Feb. 3, 2016 (398 licence stubs returned out of 1,817 licences sold in 2015; 22% return rate). Catches and efforts from the returned licence stubs are raised to total licence sales to estimate total catch and effort.

SFA 18A Mainland Gulf Nova Scotia

The estimated catches of large salmon for West River (Antigonish) and River Philip in 2015 were similar to 2014 with values lower than their long term (1984 – 2014) average (Fig. 9). The estimated catch of large salmon for East River (Pictou) increased in 2015 compared to 2014 but was still lower than the long-term average (Fig. 9). The estimated catch per rod day of large salmon for West River (Antigonish) was half the long-term average (Fig. 9). The estimated catch per rod day of large salmon for East River (Pictou) and River Philip in 2015 were near their long-term average.

The estimated catch and catch per rod day of small salmon increased in all three rivers in 2015 relative to 2014 (Fig. 9). The estimated catch of small salmon for River Philip was the second highest value since 2004 with the largest estimated catch in 2011 (Fig. 9). The estimated

catches of small salmon for West River and East River in 2015 were lower than the long-term average whereas the estimated catch for River Philip in 2015 was higher than the long-term average. The catch per rod day of small salmon exceeded the long term average for River Philip only whereas the values for West River (Antigonish) and East River (Pictou) were half their respective long-term average (Fig. 9).

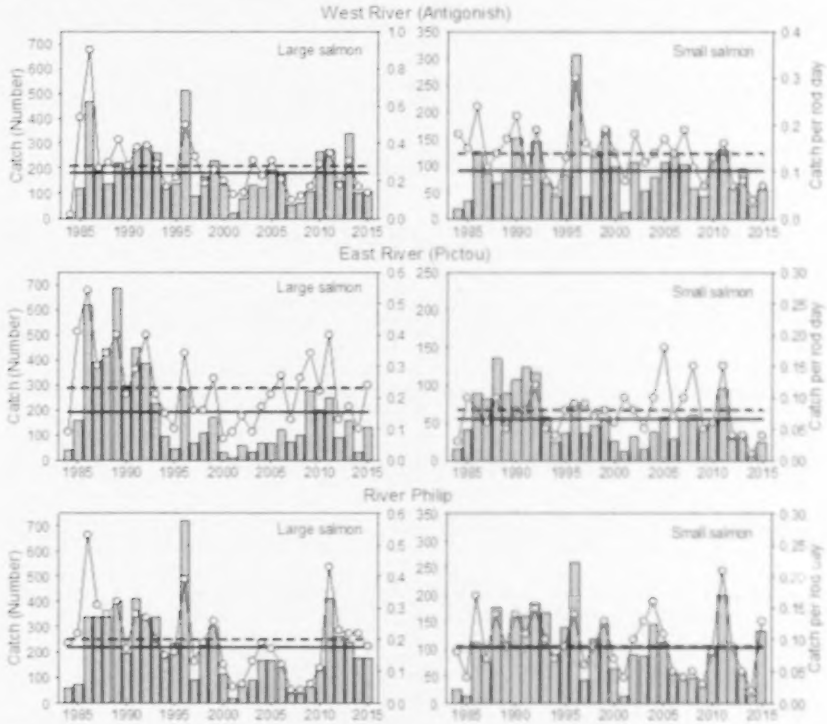

Figure 9. Estimated catches (bars) and catch per rod day (open circles) of large salmon (left panels) and small salmon (right panels) from the recreational fishery in the three largest rivers of SFA 18A, 1984 to 2015. In each panel, the solid line is the average catch and the dashed line is the average catch per rod day for the time series (1984 to 2014). The data for 2015 are preliminary. Note the different y axes range for the figures.

SFA 18B - Margaree River

The estimated catches of large and small salmon for the Margaree River in 2015 were higher than those of 2014 but below the long-term average for both size groups whereas the estimated catch per rod day of large salmon and small salmon for the Margaree River in 2015 was higher than 2014 and near the long-term average for both size groups (Fig. 10).

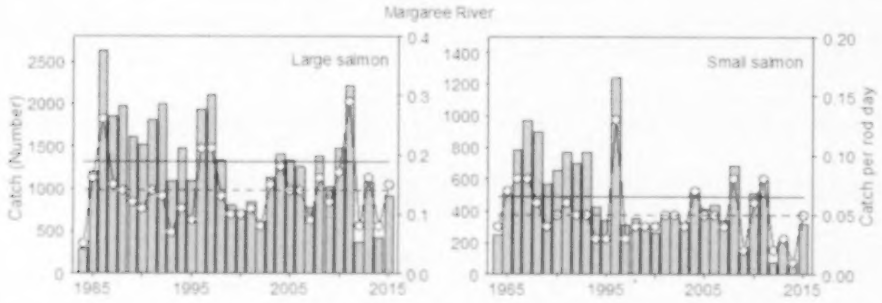

Figure 10. Estimated catches (bars) and catch per rod day (open circles) of large salmon (left panel) and small salmon (right panel) from the recreational fishery on the Margaree River (SFA 18B), 1984 to 2015. In each panel, the solid line is the average catch and the dashed line is the average catch per rod day for the time series (1984 to 2014). The data for 2015 are preliminary. Note the different y axes range for the figures.

Adult salmon abundance for the Margaree River is derived with a model that uses estimates of exploitation rates in the recreational fishery, mark and recapture experiments conducted between 1988 and 1996, corresponding recreational fishery catch and effort data recorded in volunteer angler logbooks, and licence stub returns (Breau 2013). Estimates for 2015 are preliminary and based on license stubs processed as of February 3, 2016.

The estimated returns of large salmon to the Margaree River in 2015 were 2,840 fish (median; 95% confidence interval of 2,260 to 3,580) (Fig. 11), similar to the long-term average of 2,835 fish. The lowest estimated returns of large salmon of the time series were in 2012. Conservation requirements have been exceeded every year since 1987. The preliminary estimated returns of small salmon to the Margaree River in 2015 were 920 fish (median; 95% C.I. 660 to 1,270) (Fig. 11) also similar to the long-term average of 970 fish. The four lowest returns of large salmon occurred at various times over the time series, 1992 to present, whereas for small salmon, the four lowest values were all in the last seven years.

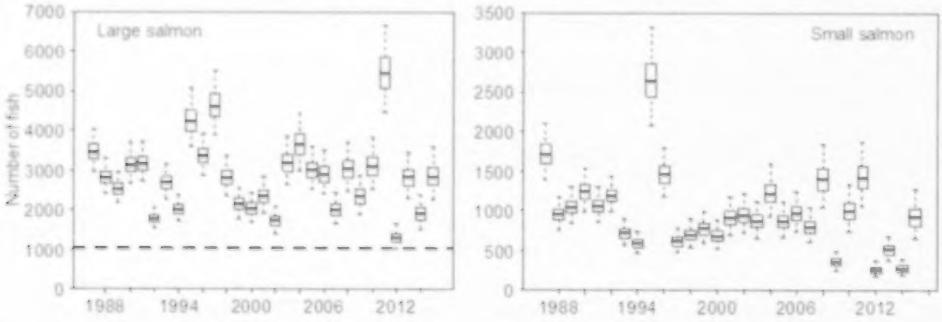

Figure 11. Posterior distributions of estimated returns of large salmon (left panel) and small salmon (right panel) to the Margaree River, 1987 to 2015. Values for 2015 are preliminary. Box plots are interpreted as follows: vertical line is the 90% credibility interval range, the rectangles are the interquartile range (50% credibility interval range) and the horizontal line in the rectangle is the median value. The dashed line in the left panel indicates the large salmon conservation requirement of 1,036 spawners.

Abundance indices of juvenile salmon

Indices of freshwater production are derived from electrofishing surveys. Fixed site sampling for juvenile salmon has been conducted most consistently since the early 1970s in the Restigouche (SFA 15) and Miramichi (SFA 16) rivers, and since the 1990s for SFA 18 rivers. Abundances at sites, in terms of number of fish per habitat area sampled by age or size group (densities), are obtained using successive removal sampling or catch per unit effort sampling calibrated to densities. Sampling intensities vary among years and among rivers. When information is available, annual densities are referenced to averages for two time periods, prior to 1984 and post-1984 (or later depending upon the age group) corresponding to the year (1984) when commercial fisheries were closed and the introduction of mandatory catch-and-release for large salmon in the recreational fishery.

SFA 15 - Restigouche River

In 2015, two to three cohorts (fry, small parr, large parr) were captured at most sampling sites (n = 65) in Restigouche (NB) indicating that there had been multiple years of spawning success. All sites sampled have become and remain occupied by juveniles with the exception of some small streams which are prone to periodic blockages to spawners by beaver dams. Mean annual densities of Atlantic Salmon fry, small parr (mostly one-year old), and large parr (mostly two-year and older) all increased post-1984 and remain at moderate levels (Fig. 12). Results from juvenile salmon surveys in 2008 and 2011, which showed decreased abundance of some age classes, could be biased due to difficult sampling conditions (extremely high water) rather than an indicator of actual lower abundance.

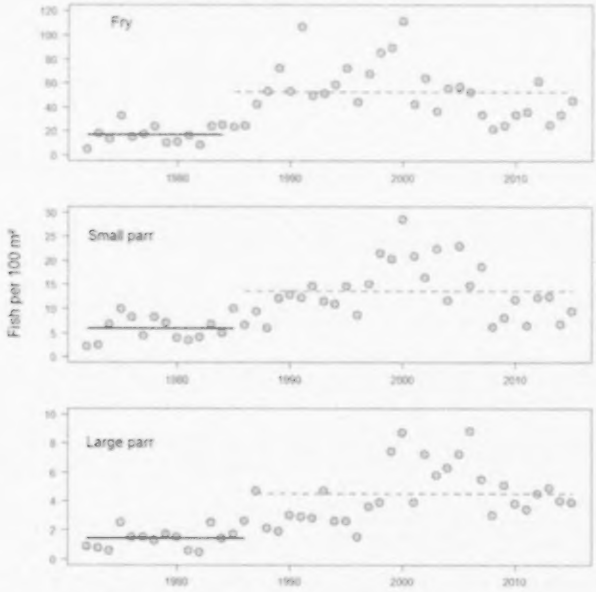

Figure 12. Mean juvenile densities (fish per 100 m²) for fry (upper panel), small parr (middle panel) and large parr (lower panel) for the sites sampled in the Restigouche River (NB waters only, excluding Matapedia and Patapedia rivers), 1972 to 2015. Horizontal solid line and the horizontal dashed line in each panel are the average densities corresponding to periods before and after, respectively, the significant management changes were implemented to the commercial and recreational salmon fisheries in 1984.

SFA 16 - Miramichi River

Densities of Atlantic Salmon fry, small parr, and large parr in the Miramichi watershed were summarized according to the four major tributaries (Southwest Miramichi [SW] and Renous within the Southwest Miramichi system, Northwest Miramichi [NW], and Little Southwest Miramichi [LSW] rivers in the Northwest Miramichi system). Average juvenile densities were calculated only when four or more sites per large river system were surveyed in a given year.

Salmon fry were captured at all 58 sites sampled in 2015 which indicates that adult salmon continue to spawn throughout the Miramichi watershed. Average fry densities in 2015 ranged between 23 (LSW) and 66 (SW) per 100 m^2 and were below the 1985 to 2015 average (Fig. 13). Above average levels of fry in 2012 corresponded to high spawning escapements, in excess of conservation requirements, in 2011. Between 2013 and 2015, average fry densities were lower than in 2012 which is consistent with low spawning escapements attained between 2012 and 2014 (Fig. 13).

In 2015, average small parr densities varied among the four main rivers from 9 (LSW) to 25 (SW) per 100 m^2 and all were below the long term (1986-2015) averages. The average large parr densities in 2015 ranged from 3 (LSW) to 8 (SW) per 100 m^2. With the exception of the Little Southwest Miramichi, the average large parr densities in 2015 were at or above the long term averages since 1987 (Fig. 13).

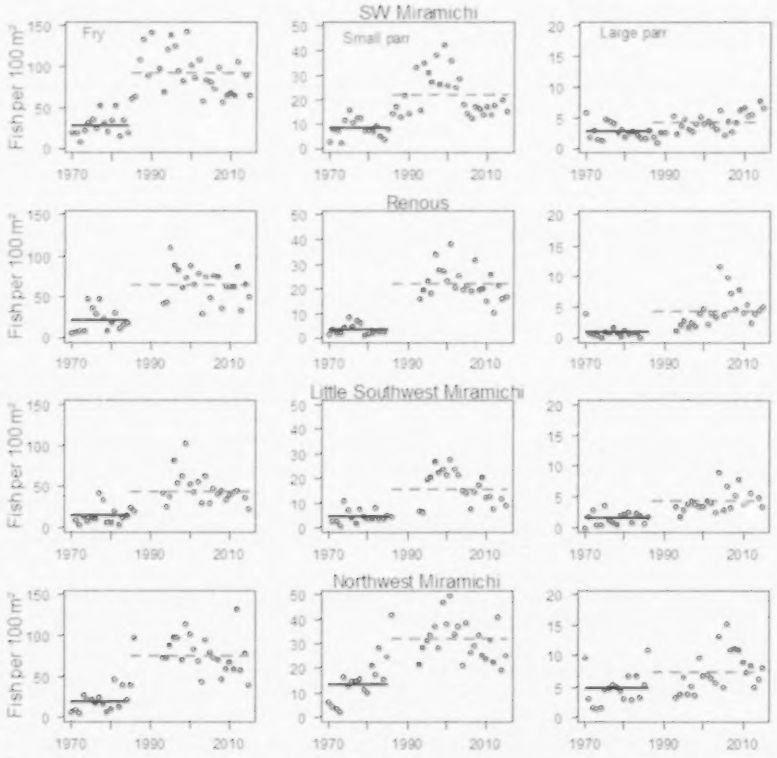

Figure 13. Annual average densities, expressed as fish per 100 m^2 of sampled area, for fry (left column), small parr (middle column), and large parr (right column) at sampled sites in the four major rivers of the Miramichi watershed: Southwest Miramichi (upper row), Renous River (second row), Little Southwest Miramichi (third row), and Northwest Miramichi (bottom row) for 1970 to 2015. The horizontal solid and

dashed lines in each panel are the average densities corresponding to periods before and after, respectively, significant management changes were implemented to the commercial and recreational salmon fisheries in 1984.

Overall, juvenile salmon abundances have varied around higher average levels since the 1984 closure of the commercial fishery and the mandatory release of large salmon in the recreational fishery. Average fry and small parr abundances have generally decreased from peaks in the late 1990s and early 2000s while large parr abundance has generally increased.

SFA 16B

In 2015, six sites were surveyed on the Buctouche River in SFA 16B. The average densities of salmon fry and parr in 2015 were the lowest or among the lowest of their time series and well below the average values since the recreational and aboriginal fisheries were closed in 1998 (Fig. 14). Salmon fry densities of over 40 per 100 m^2 were observed in the Buctouche River in 2000 following an adult salmon assessment the previous year that determined that the conservation requirement had been met. Similar levels of fry have only been observed once since then, in 2005, suggesting that spawning requirements may have been achieved in 2004.

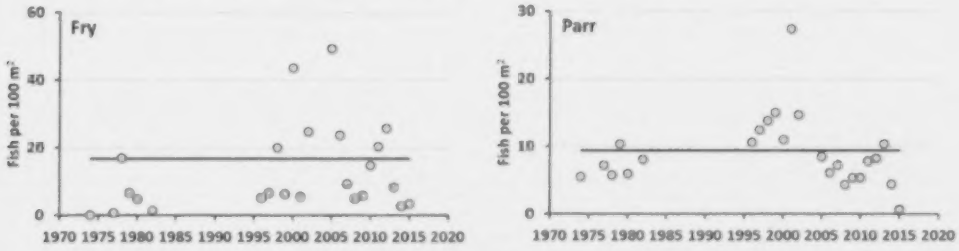

Figure 14. Average densities, expressed as fish per 100 m^2 of sampled area, for fry (left panel) and parr (size groups combined, right panel) from sampled sites in the Buctouche River 1974 to 2015 sampling years. The horizontal lines represent average fry and parr abundance for the years after the closure of the aboriginal and recreational fisheries in 1998.

SFA 18A

Juvenile salmon surveys have been conducted in three index rivers in SFA 18A: West River (Antigonish), East River (Pictou), and River Philip. Results are presented for years with at least three sites sampled per river. Since 2012, six sites have been sampled per river. All sites sampled in 2015 were occupied by juveniles. Two to three cohorts (fry, small parr, large parr) were captured at all sampling sites in 2015 indicating that there had been multiple years of spawning success. Fry abundances have been at moderate to high levels (≥ 50 fry per 100 m2) in all three rivers with a notable decline in recent years in all three rivers (Fig. 15). Parr abundances reflect the same pattern of annual abundances as fry, at moderate to high levels (≥ 20 fish per 100m2) from the mid 1990s to mid 2000s, decline in abundance for West River (Antigonish) and River Philip in recent years, and generally lower abundances of parr in East River (Pictou) (Fig. 15).

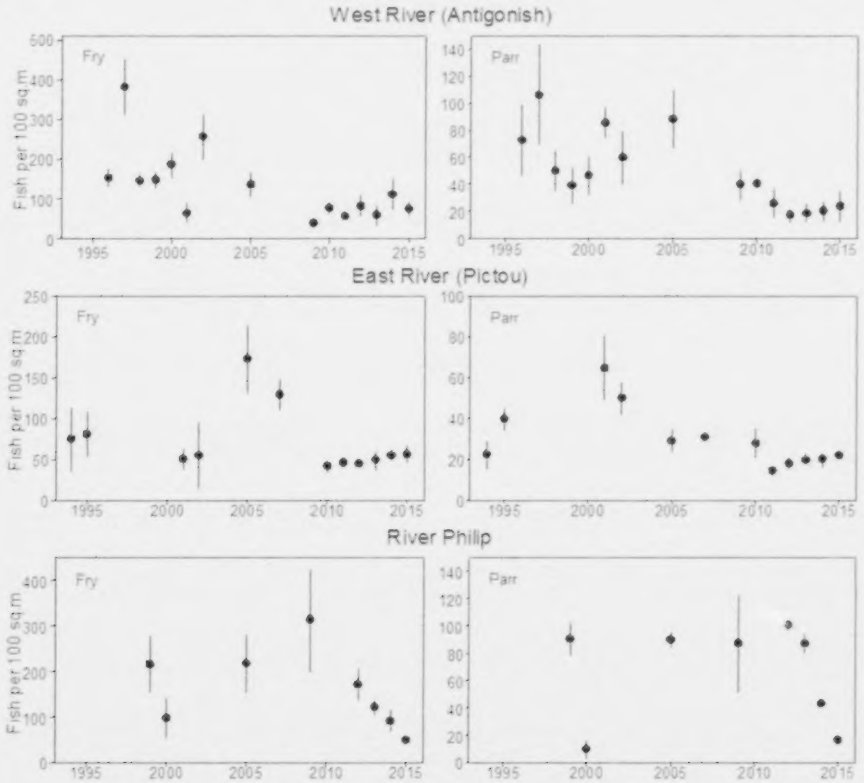

Figure 15. Mean juvenile Atlantic Salmon densities (fish per 100 m²) for fry (left panels) and parr (right panels) for sites sampled in the West River (Antigonish), East River (Pictou) and River Philip, 1994 to 2015. Only years for which at least three sites per river were sampled are presented. Vertical bars are one standard error. Note different range in y-axes.

SFA 18B

Thirteen sites were surveyed in the Margaree River during 2015. All sites sampled in 2015 were occupied by juveniles. Two to three cohorts (fry, small parr, large parr) were captured at all sampling sites indicating that there had been multiple years of spawning success. Fry and parr abundances have declined since 2008 (except 2012 for fry) and remain low compared to earlier years (Fig. 16). The lower abundance of fry in 2011 was related to a 100-year flood event in December 2010. Results from juvenile surveys in 2013 showed decreased abundance which may have been related to the high water conditions during the surveys. Abundances in 2015 were the lowest value of the time series for parr and similar to recent years of low abundance for fry (Fig. 16).

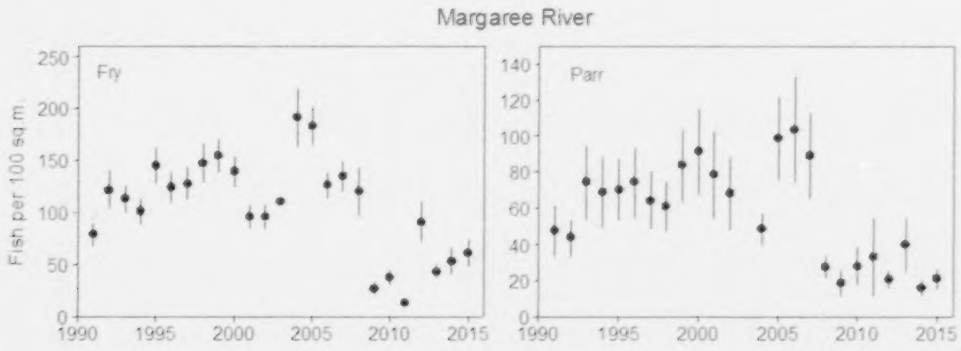

Figure 16. Mean juvenile densities (fish per 100 m² ± one standard error) for fry (left panel) and parr (right panel) for all sites sampled each year in the Margaree River, 1991 to 2015. Vertical bars are one standard error.

Conclusions

Estimates of returns of small salmon and large salmon in 2015 were improved from those of 2014 in all monitored rivers of Gulf Region. Returns of small salmon in 2015 were greatly improved from the record or near record low levels observed in 2012 to 2014 in all areas. Eggs in the combined returns of small and large salmon were sufficient to meet conservation requirement for the Restigouche River (NB; SFA 15A) and the Margaree River (SFA 18B) but were below requirements for the Miramichi River overall (89%) and for each of the branches (92% for Southwest Miramichi River, 82% for the Northwest Miramichi River). These percentages will decrease once harvests and losses from fisheries are accounted for, however the losses from the recreational fisheries in 2015 will be low because of mandatory catch and release measures in DFO Gulf Region in 2015.

Juvenile abundance indices for fry and small parr in 2015 were below the post 1984 period average in all monitored areas. Low fry abundance indices in 2015 were anticipated in the Miramichi River in particular, resulting from the near record low egg depositions values in 2014. Juvenile abundance indices have generally decreased in the past decade from peak values observed during the mid-1990s to mid-2000s, but remain above the levels of the 1970s and early 1980s in monitored rivers.

For SFA 17, the percentage of monitored rivers that exceeded the conservation requirements in 2015 (38%; 6 of 16 rivers) was higher than in 2014 (27%; 4 of 15 rivers). Salmon status ranges from strong in the northeast extremity of PEI, where several rivers are consistently above conservation requirements, to generally poor elsewhere. Outside the northeast extremity, evaluation of short-term status trends is difficult because many rivers are not surveyed every year. Salmon are considered to be at risk of extirpation in several rivers where spawning appears to occur in intermittent years.

Abundances of adult salmon in Gulf Region rivers are constrained by low marine survival, which begins from the point of assessment in freshwater near the head of tide and ends with adult returns back to the river one and two or more years later. The phenomenon of reduced marine survival is widespread for Atlantic Salmon stocks from eastern North America. Although returns of salmon were improved in 2015 from 2012 to 2014 in most rivers, the abundances in 2015 were similar or below previous 5-year and longer term (since 1992) average values.

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Sources of information

This Science Response Report results from the Science Response Process of February 18, 2016 on update of indices to 2015 for Atlantic Salmon from the DFO Gulf Region rivers. No additional publications from this process are anticipated.

Cairns, D.K., and MacFarlane, R.E. 2015. The status of Atlantic salmon (*Salmo salar*) on Prince Edward Island (SFA 17) in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/019. iv + 25 p.

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MPO. 2016. Mise à jour de l'état des stocks de saumon de l'Atlantique (Salmo salar) dans la région du Golfe du MPO (zones de pêches du saumon 15 à 18) pour 2015. Secr. can. de consult. sci. du MPO, Rép. des Sci. 2016/018.